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Use of Wireless Sensor Network in Agriculture

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ABSTRACT

As we are know that India is known for Agriculture and its byproducts at International level. Today's era is of computer so it is need farmers to ease their work through atomization. In Farming we should know about the different environmental elements like temperature, humidity, pressure, rain etc. For this purpose we can make use of Sensor & Image Processing.Wireless Senor Network (WSN) consist of thousands of inexpensive tiny devices capable of computation, communication and sensing. There are several applications in WSN such as agriculture, Medical, Environment Monitoring, IndustrialAutomation, Robotics,etc. In agricultural science, plant infections are regularly supervised by WSN. This survey paper explains about the existing methods and new methods and the development of WSN.

***Key words*- Image Processing, Microcontroller, Plant Monitoring, Sensor, Wireless Sensor Network.**

I.INTRODUCTION

Technological advance affects numerous areas like education, culture, agriculture, etc. particularly within the field of agriculture, the demand for food is anticipated to rise globally by 2030 [1], and there are several interest in achieving yield or reducing wasted food. To satisfy this, lately, agriculture business converges with technologies like IT, BT, and NT; it's developed into the next value-added business. The Agricultural environment monitoring System, for example, monitors process of growth crops in real time to manage agriculture atmosphere a lot of effectively and intelligently. Using this, we are able to give the simplest cultivation conditions like temperature, humidity, and luminosity for every crop and therefore the production of crops can increase naturally.

As good agriculture business is popular, the number of sensor nodes and network size conjointly increase in agricultural environment as a part of Wireless sensor Network (WSN) area. For example, Orchids cultivator system monitors temperature and humidness at greenhouse and incubation center using Nietzsche's sensors [2]. Several types of sensors are in agricultural environment for sensing the data, then collected information are transferred to user through the network.

Agriculture is the basis for living. Agricultural growth is considered as the backbone of country's economic development. An agricultural monitoring system provides environmental and dominant services for field that ends up in crop growth in an optimal standing. The technology utilization would be allowed for remote measuring of things like plant growth condition together with temperature, humidity, air pressure, soil wetness, water level. The wireless system conjointly improves the convenience and crop productivity [3].

Sensor Networks are deployed for a large type of applications and awareness has accrued with regards to implement technology into an agricultural atmosphere. Observance crops for detective work environmental conditions and disease detection is a very important role in successful cultivation [4]. Manual collection of information leads to variations when compared to the inaccurate measuring taken from the sphere. This could cause complications in controlling any important issue. The visual analysis of consultants is that the major sensible approach. Therefore we have to appear for quick, automatic and fewer expensive correct techniques for continuous observance of agricultural field. Wireless sensor network will reduce this effort and time needed for observance an agricultural surroundings. Crop field observance victimization WSN represents a collection of network applications with vast attainable edges for the farmers and society as a whole.

II.SENSOR NETWORK

A sensor network is associate infrastructure comprised of sensing (measuring), computing, and communication components that offers an administrator the flexibility to instrument, observe, and react to events and phenomena during such as atmosphere. A sensor is a convertor that measures a physical an associated converts it into a signal which may be read by mostly observer or by an (today principally electronic) instrument. The sensor in each node are capable of sensing and monitoring physical or environmental parameters, equivalent to temperature, sound, vibration, pressure, motion or pollutants in numerous areas.

The data obtained by every sensor can then cooperatively pass through the network to main control station; the main control station can take decisions based on the received information. The sensor nodes are deployed over a region where some parameters are to be monitored. The sensor nodes within the wireless sensor network usually consist of a radio transceiver, a microcontroller. Sensors interfaced to the microcontroller, memory module associated an energy supply to charge the sensing element node sometimes a battery. The microcontroller is the main part in the design of the sensing element node.

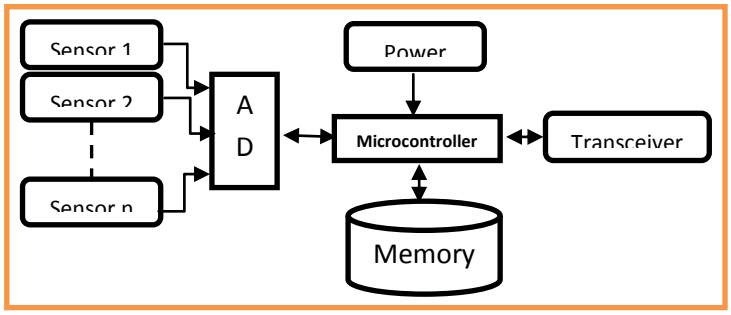

Fig. 1. Sensor Network

III.WIRELESS SENSOR NETWORK

A wireless LAN is a data transmission system designed for location independent network access by using radio waves. In agricultural environment, wireless connection is established to gather data from the various sensors and also to reduce the set up complexity. Sensor networks are the key to gathering the information needed by smart environments, whether in buildings, utilities, industrial, home, shipboard, transportation systems automation, or elsewhere.

Recent terrorist and guerilla warfare countermeasures require distributed networks of sensors that can be deployed using, e.g. aircraft, and have self-organizing capabilities. In such applications, running wires or cabling is usually impractical. A sensor network is required that is fast and easy to install and maintain. Wireless sensor networks satisfy these requirements. Desirable functions for sensor nodes include: ease of installation, self-identification, self-diagnosis, reliability, time awareness for coordination with other nodes, some software functions and DSP, and standard control protocols and network interfaces.

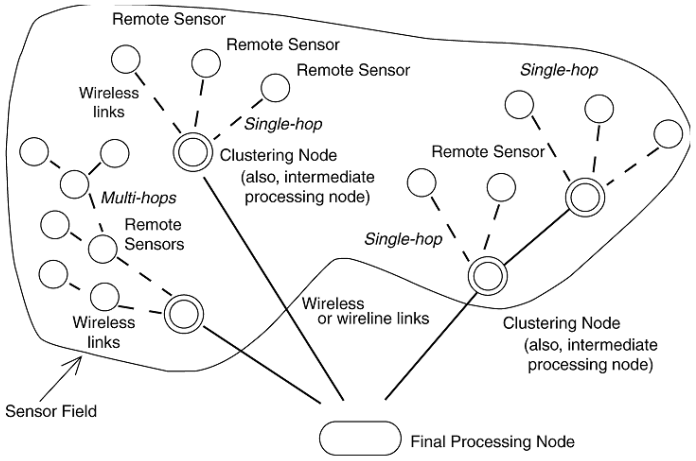

Fig. 2. Basic WSN Network

IV.PROBLEM DEFINITION FOR APPLYING SENSORS IN PRECISION FARMING

Current crop monitoring researches with remote sensing mainly focus on the macro-scale monitoring; it is difficult to acquire the instant field information at field-scale scale. The following factors prevent the application of the agricultural production and management oriented information services [5].

4.1 Special agricultural landscapes in India

The agricultural landscapes are extremely complicated. The current land use system leads to a highly decentralization in land using and land ownership, which result in extreme fragmentation in field plot. The row and relay intercropping is quite common throughout India, such as the early, semi-late and late rice, spring wheat, spring maize and soybean, summer maize and cotton. The agricultural landscape is more and more complex from north to south of India [5].

4.2 Low temporal and spatial resolution of current remote sensing image

Two types of remote sensing data are used in crop monitoring. One is low spatial and high temporal resolution data such as AVHRR and MODIS. These data covers the target area daily, but their spatial resolution is 250-1000m. The mixed pixel problem declined the accuracy and reliability of the monitoring results. The other is the high spatial resolution and low temporal resolution data such as Landsat TM/ETM, CBERS-CCD and HJ-1 CCD. Their spatial resolution is 20-30m, but the temporal resolution is 8-26 days. Due to their low temporal resolution, instant and continuous monitoring could hardly be achieved [5].

4.3 Low accuracy of crop and environment info from current remote sensing models

The crop parameters for monitoring the key crop and environment info mainly include crop biophysical parameters (leaf area index, vegetation coverage), crop bio-chemical parameters (nitrogen/chlorophyll content, etc.) and crop growing environment parameters (such as soil moisture, surface temperature). In addition to the spatial and temporal resolution problem, the accuracy of remote sensing derivation of field parameters is also a major problem. The accuracy was affected by spatial resolution, noise, atmospheric conditions, as well as other factors such as the accuracy of model inversion [5]. Generally the inversion accuracy of crop biophysical parameters, biochemical parameters and environment parameters can only achieve an accuracy of 85%, 80% and 90%, which cannot meet the need of operation and monitoring.

4.4 Lack of effective information releasing channel

Usually the crop monitoring result are released in World Wide Web in the form of HTTP web pages. Yet the main users of crop and environment info monitoring result in India are farmers. Yet their access to web is denied due to lack of computer, connection to World Wide Web and elementary skill to operate a computer. A munch easier and cheaper information releasing channel is to be developed to help the farmers not only access to the information but also understand it's meaning [5].

V.WIRELESS SENSOR NETWORK IN AGRICULTURE

An efficient wireless sensor network platform is suitable for agricultural application in developing countries. This method utilizes minimum power consumption during all phases of data processing like acquisition, sampling and compression with an efficient communication protocol [6]. The sensor nodes are independent, easy to locate and relocate.

In agricultural environment monitoring system, various kinds of sensors are deployed in greenhouse to collect the data; for example, temperature, humidity, and intensity of light, etc. In general, monitoring system uses these sensing dataset to find the most suitable growth conditions for the cultivated crops. If there are not suitable data for ideal conditions, feedback are transferred from control center to sensor for returning to good conditions [10].

In [7] he developed microcontroller based monitoring system for agriculture. The authors designed microcontroller to display the real time values of atmospheric condition. Different agricultural parameters such as soil moisture, humidity and temperature are continuously monitored and collected data is given to microcontroller. As a result, by analyzing collected data, watering to crop can be schedule.

In [8], wireless sensor network architecture for vegetable greenhouse is proposed in order to achieve scientific cultivation and lower management costs from the aspect of environmental monitoring. According to the analysis of the features of greenhouse environment, a practical and low-cost greenhouse monitoring system is designed based on wireless sensor network technology in order to monitor key environmental parameters such as the temperature, humidity and illumination.

In [9], the authors developed an integrated WSN-based system for crop monitoring, video-surveillance and process of cultivations control. To detect and identify intruders (human or animals), video-surveillance was used to better take care of the production process. The proposed system architecture has been deployed and tested in a real agricultural environment. The results obtained from the real deployment with the new prototypes are comparable to those from computer simulation and analysis from energy consumption and frame transmission delay point.

Like above related works, there are many works to monitor and control crop condition in greenhouses. So, we think these monitoring system is effective to grow crops in greenhouse. However, most related works don't consider large volume of data problem. They perform only data analysis to find optimal growing condition. As the number of devices increase, network traffic for monitoring increase greatly and network congestion more deteriorates as forming multi-hop communication. Therefore, to operate effectively and enhance agriculture monitoring system, data processing is necessary [10].

VI.CONCLUSION

The agriculture area is inevitable element in human life from old times and in future. As the agriculture industry is enhanced with technological advance, people can check and control easily various sensor devices. As entering IoT era, more and more devices will communicate and share their data in agriculture area. For supporting connectivity among devices, RPL protocol can be considered promising protocol in IoT. Some existing technologies of WSN in agriculture are discussed in this paper. The new technology involves detecting some environmental conditions and crop diseases effectively.

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